Empirical modelling of the effect of airflow on oven temperature control in cake baking

ABSTRACT

Understanding the dynamic behaviour of oven temperature is important to ensure proper temperature control during baking. This paper presents the development of an empirical model for the cake baking process with airflow. Increasing the airflow velocity to 100% and the baking temperature by 10°C reduced the temperature overshoot by 75%ï 86% at the oven centre. The resulting moisture contents of the cakes exhibited 8% differences or less. Empirical models were developed by applying step changes in the baking temperature and airflow velocity and can be represented by second-order-plus-time-delay (SOPTD). The response to changes in airflow was 61% faster compared to changes in baking temperature, which indicated that airflow is more significant in influencing convection heat transfer during baking.

Keyword: Cake baking; Airflow effect; Empirical modelling; Oven temperature control; Temperature dynamic behaviour